D2

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 013 365 A1

(12) EUROPEAN PATENT APPLICATION

(43) Publication Date: **06-28-2000**
Patent Office Journal

(51) Int. Cl.[7]: **B23B 27/14**

(21) Application No.: 99204337.2

(22) Application Date: **12-16-1999**

(84) **Indicated Contractual States:**
AT BE CH CY DE DK ES FI FR GB GRIE IT LI LU MC NL PT SE
Indicated Extension States:
AL LT LV MK RO SI

(30) Priority: **12-22-1998 AT** 85198

(71) Applicant:
Plansee Tizit Aktiengesellschaft
6600 Reutte /Tirol (AT)

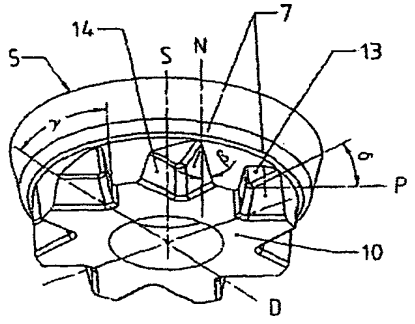
(72) Inventor:
- **Ertl, Christian**
  6600 Reutte (AT)
- **Koch, Wolfgang**
  6600 Reutte (AT)

(74) Represented by:
Lohnert, Wolfgang, Dr.
C/O PLANSEE AKTIENGESELLSCHAFT, Recht/Patent
6600 Reutte/Tirol (AT)

(54) Cutting Tool

(57) The invention concerns a cutting tool, comprised of a tool base -1- exhibiting one or multiple seats for the mounting of a indexing insert with at least sectional cylinder or truncated-cone-shaped contact surfaces for corresponding bearing surfaces -4- of the tool base. For the indexing, the cutting insert –5- exhibits in its tool flank or in a section bordering the tool flank –11- multiple lateral, roof-shaped notches –6- with one indexing surface –7- each, being designed to rest against the end –9- of a stop –8- at the tool base –1-. The individual indexing surfaces –7- are slanted at an angle ß between 5° and 20° in reference to a perpendicular line N to the base –10- of the indexing insert –5-. The intersecting line of the each respective indexing surface –7- with the base –10- runs at an angle γ between 15° and 45° in reference to the diameter line D, which runs through the inner radial end of the respective intersecting line.

Fig.: 2



EP 1 013 365 A1

Description

[0001] The invention concerns a cutting tool comprised of a tool base and one or multiple cutting inserts, the tool base with one or multiple plate seats with one seat-engaging surface each and one or multiple lateral bearing surfaces for the mounting of an exchangeable cutting insert with at least sectional cylinder or truncated-cone-shaped tool flanks as contact surfaces with one or more lateral bearing surfaces, whereby the cutting insert in the flank or in a section bordering the flank exhibits multiple lateral roof-shaped notches with a flat indexing surface each, and whereby the cutting insert can be placed into predetermined, different positions via a stop projecting from the tool base with its end resting against an indexing surface.

[0002] The majority of replaceably installed cutting inserts in tool bases for cutting are equipped with multiple cutting edges, which through positional changes of the cutting inserts in the tool base holder are then used consecutively. In many cases, the exact position of the respective cutting edge is automatically predetermined due to the external geometry of the cutting insert, e.g. in the form of a triangular, rectangular or hexagonal shape being matched to the plate seat at the tool base for the mounting of the cutting insert.

[0003] At the same time, due to the matching of the plate seat at the tool base to the respective cutting insert, this type of device provides good anti-twist protection for the cutting insert against the cutting forces that are being generated during the chipping or cutting process.

[0004] More difficult is the torsion-locked, exact positioning of cutting inserts, which are designed in the shape of a round plate or with at least sections of a curved outer contour. In these cases, the cutting insert cannot be automatically torsion-locked and positioned because of the circular bearing surface.

[0005] In order achieve exact positioning and torsion-locked mounting for such cutting insert it is known that at least sections of the truncated-cone-shaped or cylindrical flank should have flat positioning surfaces, which interact with equally flat surfaces on the bearing surface of the tool base. The disadvantage of these designs is the fact that when the cutting inserts are fastened, which, as a rule is done with a fastening screw through a center hole in the cutting inserts, the tightening force of the screw and the resulting friction between the screw and the center hole of the cutting insert cause the cutting insert to slightly twist and therefore to be pushed away from the bearing surface.

[0006] Due to the tolerance clearances between the individual positioning surfaces and the low resistance during continued indexing, the exact position of the cutting insert must be adjusted through a slight rotation up to the actual stop, which again may cause a slight change in the position of the cutting inserts during the chipping/cutting process.

[0007] Furthermore known is the fact that said cutting inserts can be created through notches in the base or tool flank, into which a pin that is attached to the tool base engages accordingly. Through this type of solution according to DE-OS 42 44 316 it has become known that the pin can either be attached perpendicular to the seat-engaging surface while engaging with indexing surfaces into corresponding recesses incorporated into the base of the cutting insert, or horizontally at the side of the tool base, and having the end of the indexing pin rest in indexing surfaces at corresponding notches in the tool flank of the cutting insert. This solution has the disadvantage that when the pin is installed perpendicularly in the tool base, the tool base will be weakened by the borehole for the pin in the seat-engaging surface for the indexable insert and therefore, during long use of the tool base, the cutting insert may work its way into the seat-engaging surface, thereby compromising the secure seating.

[0008] When the pin is installed horizontally in the tool base, the notches in the sides of the cutting insert's flank must be very deep in order to ensure that the pin rests properly against the indexing surfaces. This has, in addition to a greater weakening of the cutting insert, the disadvantage that in order to rotate the cutting insert into a new position, the cutting insert must be lifted very high off the seat-engaging surface of the tool base, so that if the cutting insert is attached with a screw through a hole in the center of the cutting insert, the screw connection would practically have to be completely opened.

[0009] This invention has the objective to provide a cutting tool for the installation of indexable cutting inserts, in which said disadvantages will be avoided.

[0010] The invention solves this task in a manner wherein the individual indexing surfaces are slanted at an angle ß between 5° and 20° in reference to a vertical line N onto the base of the cutting insert, with the intersecting line between an indexing surface and the base surface with this diameter line D – relative to the cylinder or truncated-cone shaped flank – forming an angle γ of between 15° and 45° and intersecting

with the inner radial end point of this intersecting line.

[0011] In this embodiment, the lateral notches in the tool flank can be designed to be small, so that an excessive weakening of the cutting insert will be avoided, while continuing to ensure stable contact to the respective indexing surfaces at the stop. In this case, the cutting insert must only be lifted off a small distance in relation to the stop in order to rotate it to the next consecutive notch.

[0012] After the stop locks into the indexing notch, a slight rotation of the cutting insert against the rotational indexing direction achieves secure contact of the indexing surface with the end of the stop. In this case it is important that the lateral notches are arranged in such fashion that the cutting forces affecting the indexable insert during the chipping/cutting process press the indexing surface onto the end of the stop in order to prevent the cutting forces from changing the position of the cutting insert.

[0013] An especially advantageous handling of the cutting insert's indexing is being ensured if the individual indexing surfaces are slanted at an angle ß between 9° and 14°. If the indexing surface forms an angle ε of 90° with the adjacent surface of the respective roof-shaped notch, the proper design of the stop and compliance with the allowable tolerances achieves secure and definite indexing, since in this case, either the indexing surface or the adjacent surface of the cutting insert rests securely against one of the respective counter surfaces of the stop.

[0014] The stop may be embodied either in one piece with the tool base, which is manufactured through the appropriate mechanical processing, or as a separate part that is attached to the tool base.

[0015] As an advantageous variation of the second embodiment it has been proven advantageous to design the stop as a pin, preferably from hardened steel, which is incorporated into the seat-engaging surface of the tool base. This design option is especially easy to manufacture. The pins should be standard pins with a cambered surface at one end for the contact with the indexing surface, and with a cone-shaped opposite end for easy insertion of the pin into the borehole in the tool base, into which the pin is lightly pressed.

[0016] The great advantage of such pin design is the fact that the borehole for the pin in the tool base is located largely outside the seat-engaging surface for the cutting insert, which therefore remains largely unweakened and will not be warped by the cutting insert, even after heavy use.

[0017] A particularly practical embodiment is provided, when the angle α, which the pin forms with the seat-engaging surface of the tool base, and the angle ß, which the individual indexing surfaces of the cutting insert form with a perpendicular line N on the base surface, are of equal size. The result is that the individual indexing surfaces make contact in the center at the end of the pin.

[0018] For some applications it might be advantageous to incorporate the lateral roof-shaped notches not at the cutting insert itself, but on a support plate located between the cutting insert and the seat-engaging surface of the tool base. In this case, appropriate measures must be taken to ensure that the connection between the cutting insert and the support plate is rotation-free.

[0019] The embodiment of an indexing device according to the invention is particular advantageous when the cutting insert is an indexable insert with a center hole attached to the tool base via a screw extending through the center hole. In this case, the further indexing of the cutting insert does not require the complete loosening of the screw; instead, two to three rotations are sufficient to free the indexable insert for further indexing.

[0020] Further advantages are provided when the respective face of the roof-shaped, lateral notches form an angle δ of between 5° and 35° with a parallel line P onto the base surface. Keeping this angle in the prescribed range ensures first the definite freeing of the cutting insert in order to change the indexing position, and second, the proper contact of the stop with the respective indexing surface.

[0021] Especially advantageous is a design, in which the cutting insert has eight lateral notches being distributed symmetrically around the circumference at a 45° angle each.

This provides on one hand sufficient stability of the cutting insert, which has been weakened by the lateral notches, and on the other hand a large number of cutting edge sections for different purposes.

[0022] Following is an explanation of the invention supported by drawings. Shown are in:

Figure 1 a 3-D representation of an indexable insert for a cutting tool according to the invention at a diagonal view from above

Figure 2 a 3-D representation of the indexable insert according to Fig. 1 at a diagonal view from below

Figure 3 a 3-D representation of an indexable insert according to the invention (exploded view)

Figure 4 a 3-D representation of a variation of a cutting tool according to the invention (exploded view)

Figure 5 a cross-sectional view of the cutting tool according to the invention per Figure 3

[0023] In Figures 3 to 5, the cutting tool according to the invention is represented as part of a milling tool with a plate seat for a round indexable insert –5-, which in Figures 1 and 2 is shown enlarged.
[0024] The tool base –1- of the milling tool contains a plate seat with a seat-engaging surface –3- and two lateral bearing surfaces –4- for a round indexable insert –5- with center hole. The indexable insert –5- has adjacent to the tool flank a cylinder-shaped section –11- with 8 lateral, roof-shaped notches –6-. Each one of these notches –6- has an indexing surface –7- being slanted at an angle ß of 11° onto a perpendicular line N at the base surface –10-. Simultaneously, the line of the indexing surface –7- intersecting with the base surface –10- runs at an angle γ of 22,5° onto the diameter line D, which runs through the inner radial end of the intersecting line. The surface of the roof-shaped notch –14- adjacent to the indexing surface –7- forms an angle ε of 90°. The face –13- of the notch –6- runs to the base surface –10- of the cutting insert, sloping towards the symmetry axis S at an angle ß of 30°. The milling tool according to Figure 3 has a stop –8-, which has been milled out of the tool base in one piece together with the tool base body –1-. The top of the stop –8- runs parallel to the seat-engaging surface, its end surface –9- runs perpendicular to it. The sectional view of the assembled state of the indexable insert –5- in Fig. 5 clearly shows the contact of the indexing surface –7- with the end surface –9- of the stop –8-. In the variation of a
[0025] milling tool per Fig. 4, the stop –8- is designed as a round pin, which is inserted diagonally into a borehole –15- at the tool base –1- at an angle of 11°.

Patent Claims

1. Cutting tool comprised of a tool base (1) and one or multiple cutting inserts (5), a tool base (1) with one more plate seats with one seat-engaging surface (3) each, and one or multiple lateral bearing surfaces (4) for acceptance of an exchangeable cutting insert (5) with at least a sectional cylinder or truncated-cone-shaped flank as contact surface with one or more lateral bearing surfaces (4), whereby the flank (5) of the cutting insert (5) or a section bordering the flank (11) exhibits multiple lateral, roof-shaped notches with (6) with one flat indexing surface (7) each, and which can be positioned in different predetermined positions via a stop (8) that is attached to a tool base (1), with the end (9) of the stop resting against an indexing surface (7).
wherein the individual indexing surfaces (7) are slanted at an angle ß of between 5° und 20° in reference to a perpendicular line N on the base (10) of the cutting insert (5), and that the intersecting line between one indexing surface (7) and the base surface (10) with the diameter line D – in reference to the cylinder or truncated-cone-shaped tool flank – forms an angle γ of 15° to 45° intersecting with the inner radial end point of this line.

2. Cutting tool according to claim 1, wherein the individual indexing surfaces (7) are slanted at an angle ß between 9° and 14°.

3. Cutting tool according to claim 1 or 2, wherein the indexing surface (7) and the adjacent surface (14) of each roof-shaped notch (6) form an angle ε of 90°.

4. Cutting tool according to one of the claims 1 to 3, wherein the stop (8) is a pin incorporated into the seat-engaging surface (3) of the tool base body (1) forming an angle α between 5° and 20° with the seat-engaging surface (3).

5 Cutting tool according to claim 4, wherein the pin (8) and the individual indexing surfaces (7) are slanted at the same angle α, ß.

6 Cutting tool according to one of the claims 1 to 5, wherein the section (11) bordering on the tool flank is a rotation-protected support plate connected to the cutting insert (5).

7 Cutting tool according to one of the claims 1 to 6, wherein the cutting insert (5) is an indexable insert with a center hole attached to the tool base (1) via a screw extending through the center hole (12).

8 Cutting tool according to one of the claims 1 to 7,

wherein the respective face (13) of each roof-shaped lateral notch (6) forms an angle δ of between 5° and 35° with the parallel line P to the base surface (10).

9 Cutting tool according to one of the claims 1 to 8, wherein the cutting insert (5) is a round plate with eight lateral notches (6) distributed symmetrically at a 45° angle along the circumference.

10 Cutting insert for use in a cutting tool in accordance to one of the claims 1 to 9.

Fig.: 1

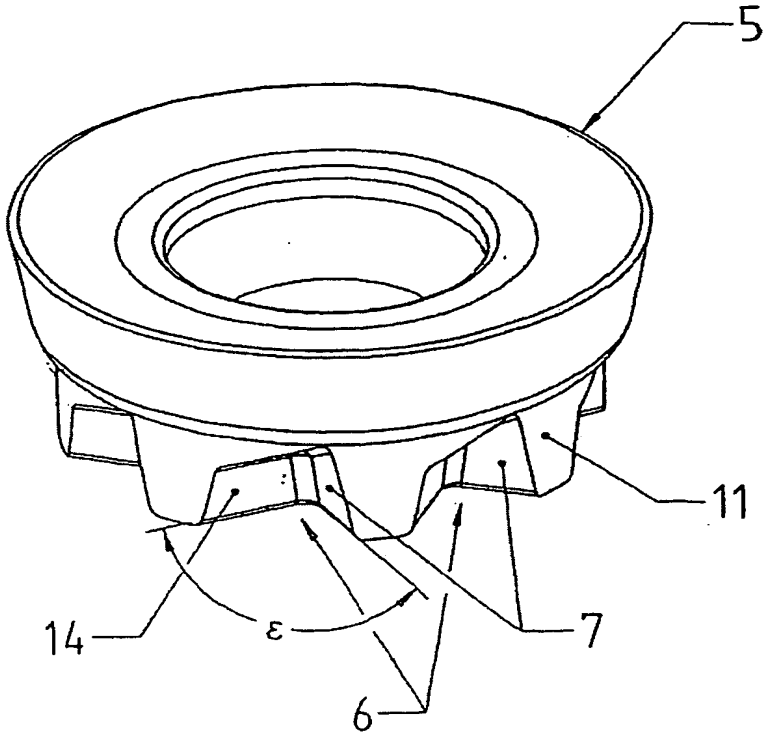


Fig.: 2

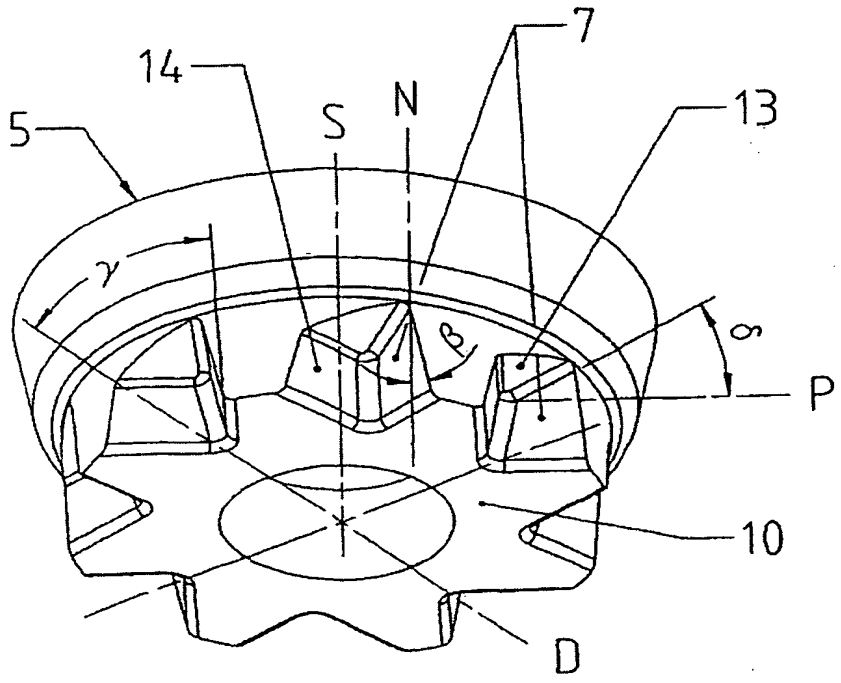


Fig.: 3

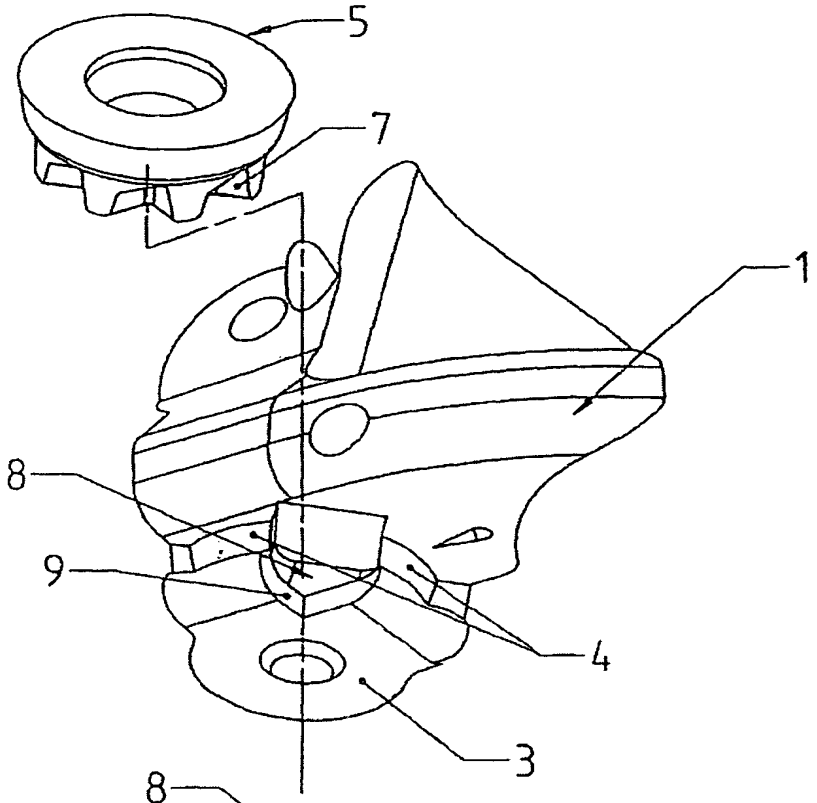


Fig.: 4

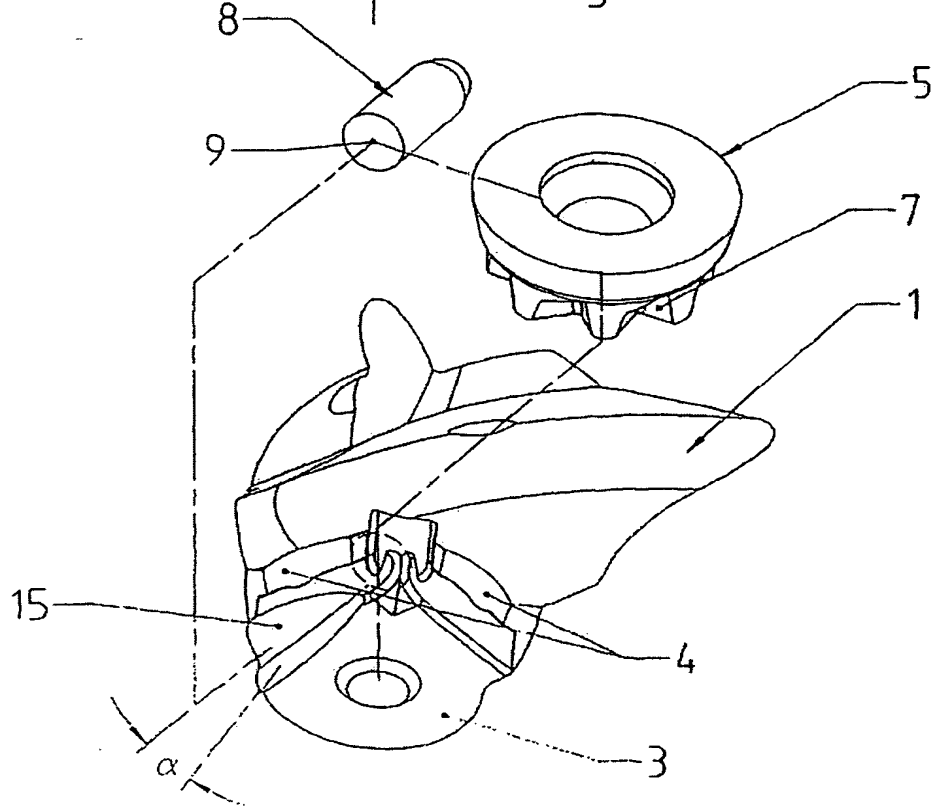
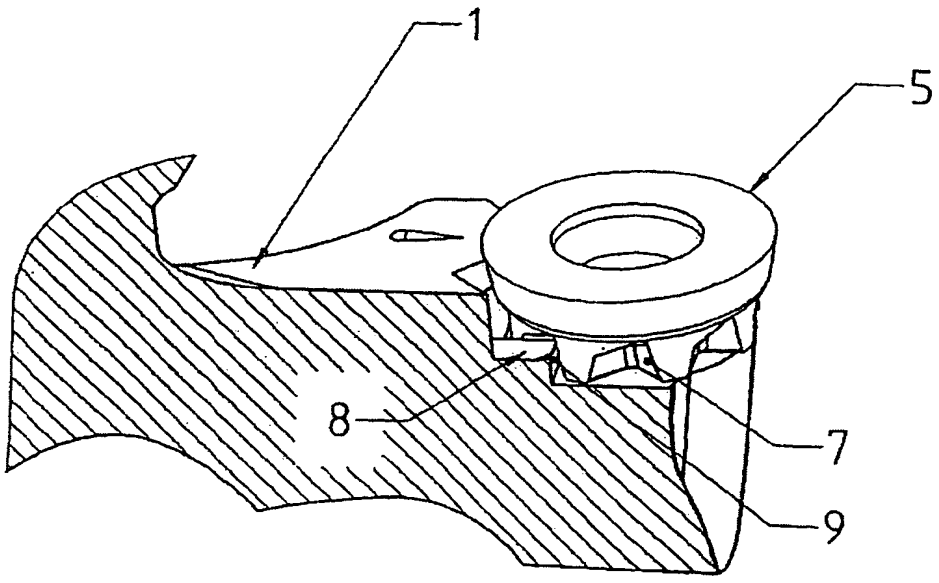


Fig.: 5



European Patent Office

EUROPEAN RESEARCH REPORT

Application Number
EP 99 20 4337

RELEVANT DOCUMENTS

Category	Description of the document with indication of the relevant parts, if necessary	Claim Reference	APPLICATION CLASSIFICATION
A	WO 98 26892 A (ISCAR) 25 June 1998 (1998-06-25) * Page 10, Line 12 - Page 18, Line 29; Figures 1,3-6 *	1,7,9,10	B23B27/14
A	WO 98 01249 A (SANDVIK) 15 January 1998 (1998-01-15)		

RESEARCHED SUBJECT MATTERS

B23B

This research report has been prepared for all patent claims.

Research Location	Research Completion Date	Examiner
DEN HAAG	20 March 2000	Bogaert, F

CATEGORIES OF THE LISTED DOCUMENTS

X: Of special importance alone
Y: Of special importance in conjunction with another publication of the same category
A: Technical Background
O: Non-written Disclosure
P: Intermediate Literature

T: Theories and principles the invention is based on
E: Older patent published only on or after the application date
D: Document listed in the application
L: Document listed for other reasons

&: Member of the same patent family; matching document

EPO FORM 1503 03.82 (P04C03)

APPENDIX TO THE EUROPEAN RESEARCH REPORT
ABOUT THE EUROPEAN PATENT APPLICATION No. EP 99 20 4337

This appendix lists all members of the patent families of the patent document listed in the above-mentioned European Research Report.
The information about the family members match the status of the file at the European Patent Office on 03-20-2000
These data are for information only and are not guaranteed.

Patent Document listed in the Research Report	Date of Publication	Members of the Patent Family	Date of Publication
WO 9826892 A	25-06-1998	AU 3862297 A	15-07-1998
		AU 5408398 A	15-07-1998
		DE 29721160 U	19-02-1998
		EP 0964763 A	22-12-1999
		EP 0944451 A	29-09-1999
		WO 9826893 A	25-06-1998
		NO 992444 A	06-08-1999
WO 9801249 A	15-01-1998	SE 510852 C	28-06-1999
		EP 0912281 A	06-05-1999
		SE 9602724 A	11-01-1998

EPO FORM P0461

EXPERT TRANSLATION BUREAU, INC.

920 W. Lakeside, Suite 2109, Chicago, IL 60640
Telephone: (773) 271-5500 Facsimile: (773) 728-1370
www.Expert-Translation.com

CERTIFICATE OF TRANSLATION

September 12, 2005

I, Angela Christie, hereby certify that I am competent in both English and German languages. I further certify that under penalty of perjury translation of the aforementioned patent:

[EP 0 398 867 A2]

from the German language into the English language is accurate and correct to the best of my knowledge and proficiency.

Angela C. Christie

Professional Translator

OFFICIAL SEAL
ALEXANDER GOFMAN
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 8-8-2009

Alex Gofman

09. 12. 2005